Using the Principles of Animation to Predict Allocation of Attention

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Viewer's attention allocation and direction has been carefully observed and quantified by successive experimental psychological research. Active vision approaches have highlighted how the context of the viewer and the task requirements at hand modulate and in many cases predict the location of eye gaze fixation. Posner (1980, p. 4) defined the orienting of attention as "the aligning of attention with a source of sensory input or an internal semantic structure stored in memory". Its primary means are foveating eye movements with a focal point centering the area of interest. The allocation of attention with biologically relevant cues such as eye-gaze has been demonstrated in a number of paradigms such as the Posner paradigm and more recently the flicker paradigm (Langton, 2006). In both main paradigms, the emphasis within the evaluation of attention allocation has been the static pictorial properties of the pictures used as stimuli. With recent research (Martinez et al. 2011) demonstrating that fully-animated cues can have a stronger effect on viewer allocation of attention than static or 2-frame animations (see Fig. 1), it is clear that there is scope for future research into the application animated stimuli as a means of predicting audience eye movements.

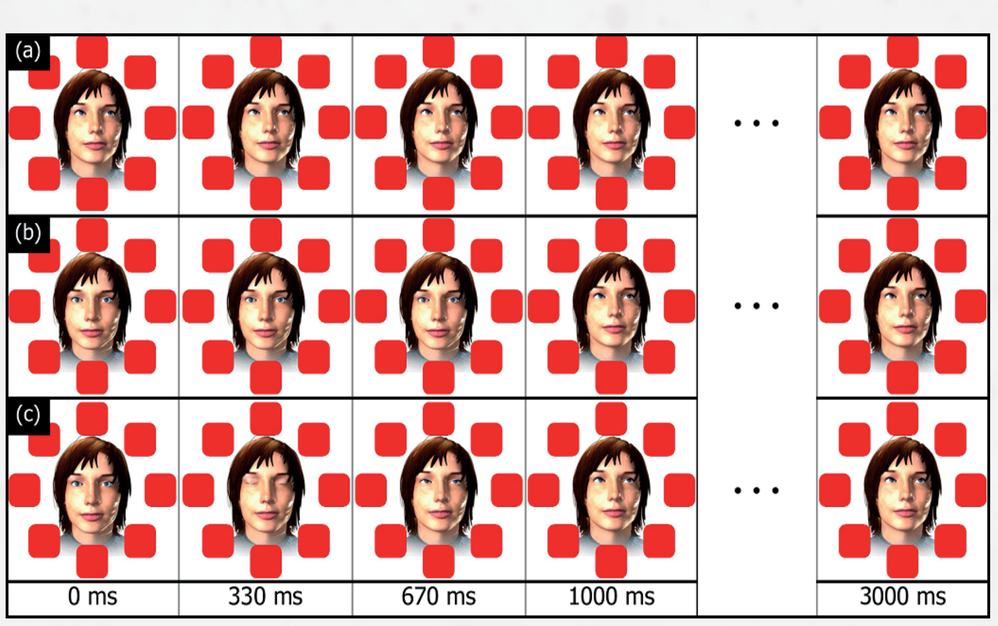

Fig. 1: The appearance of the three types of agent-based cues over 1000 ms. Agents used head orientation and gaze to highlight one of eight targets. In the above example, three types of agent are shown highlighting the NE target; (a) shows a static (1-image) agent, which highlights the NE target from 0 ms onwards, (b) shows a stepped (2-image) agent, which looks towards the observer in frame 1 (from 0 ms) before changing to highlight the NE target in frame 2 (from 960 ms), (c) shows a dynamic (25-image, 25 fps) agent, which begins at 0 ms by looking at the observer, and is animated with natural movement so that the head and gaze shift towards the NE target at 960 ms. Assessment of observer response time demonstrated that the dynamic agent was the most efficient when it came to allocating attention.

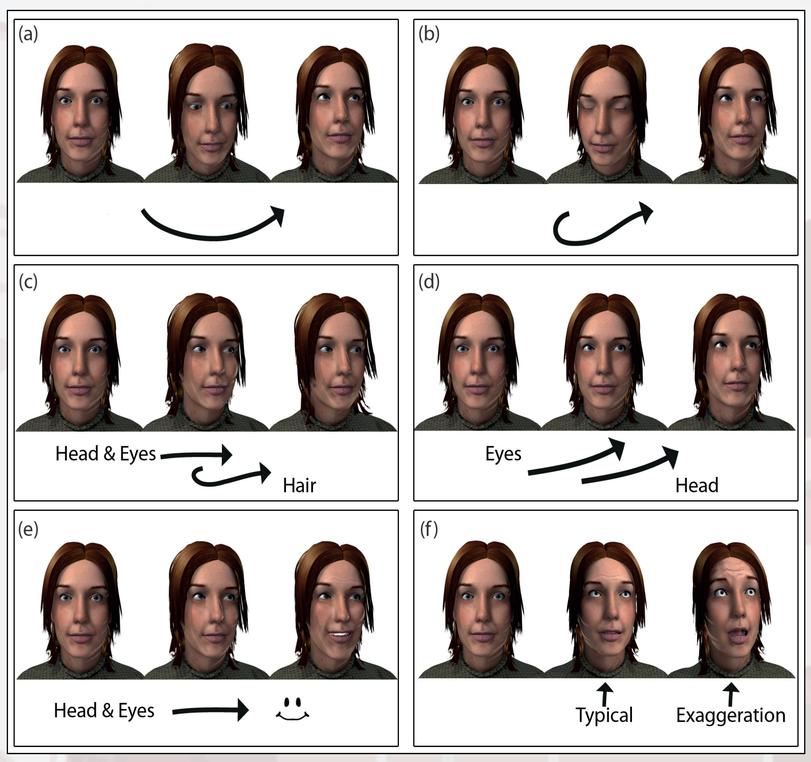

Fig. 2: Examples of principles of animation as applied to a simple head and gaze cue; (a) application of Arcs to generate smooth movement, (b) application of Anticipation to prepare the viewer for the cue, (c) application of Follow Through with the hair continuing to move after the head stops, (d) application of Overlapping Action with the eyes leading the head movement, (e) application of Secondary Action in the form of an expression, (f) application of Exaggeration to enhance the appearance of the expression.

The principles of animation (Thomas and Johnston, 1981) were developed through practice-based research, rather than through application of the scientific method. It was the value judgments of the expert practitioners that determined which techniques had the best effects, not measurement of audience response. Those techniques that resulted in animated movements that were pleasing to the eye, and that most concisely communicated the meaning and emotion of a story, became known as the principles of animation.

With the principles of animation as a conceptual framework, predictions of observer allocation of attention can be made. Fig 2 shows some of the key principles of interest applied to a virtual character; Arcs, Anticipation, Follow Through, Overlapping Action, Secondary Action, and Exaggeration. The authors suggest that prediction of attention allocation can be guided by these principles, and that animations designed with reference to the principles will enhance engagement with digital environments.

References

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